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Report on a Fatality due to Rattlesnake Bite

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On the evening of October 15, 1953, a 22-month-old child was found unconscious in a cotton patch near Goodyear, Arizona. Although a distance of only 20-odd miles was involved, two hours lapsed before the patient was presented for treatment at Good Samaritan Hospital in Phoenix. The attending doctors, Thomas Bate and Sam Johnson, were told that when the parents found the child he was bleeding profusely from the right eye and from a puncture wound on the left side of the bridge of the nose. Five closely-spaced punctures on the right side of the chin and a superficial quarter-inch laceration on the right side of the lower lip were present, but neither of these latter wounds was bleeding. There were no further breaks in the skin.

At the time of entry into the hospital, the child was still bleeding freely from the right eye and from the puncture wound on the nose. Massive ecchymoses were present interorbitally as well as down the left side of the face and, to a lesser extent, down the right. The right eye was so swollen that the lids could not be opened for the purpose of ascertaining the source of bleeding. Respirations were rapid and shallow, and the pulse was greatly accelerated, although the exact rate is unknown.

All attempts to control bleeding from the right eye were futile, and the eye, as well as the puncture mark on the nose, bled until death six and one-half hours after entry. It was realized by the attending physicians that the outcome would be fatal, but shallow incisions were made into the swelling by Dr. Bate in the hope that some of the venom could be extracted. Intermittent suction was instigated on the incisions until death ensued. Twenty-five milligrams of Cortone were administered intramuscularly, and the dosage was repeated a short time later. Three hundred thousand units of penicillin and 250 cc. of lactate ringers were administered. Death intervened before routine laboratory procedures

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could be carried out, so nothing is known of the blood and urine. Cyanosis and pulmonary congestion became marked, and as air hunger developed oxygen was administered by respirator. At this time respirations were 74 per minute and the pulse was quite rapid. As the typical aconitic effect of rattlesnake venom developed, the pulse rate decreased ; shortly before death the pulse was 40 per minute. It should be noted that the eventual respiratory paralysis was secondary rather than primary and was due to intracranial anoxia. Air hunger was present to the last, as characterized by typical convulsive gasps on the part of the patient.

There was some question among the attending physicians as to whether the child had been killed by a snake and an autopsy was ordered. I was invited to be present and thus gained my first knowledge of the case.

Unfortunately the child was embalmed before the autopsy as a courtesy to the morticians. However, the pathologist, Dr. R. E. Campbell, performed a thorough dissection and very little information was lost as a result of the embalming fluid. As first seen, the patient was a 22-monthold male, well-nourished, and weighing about 30 pounds. Purpura was present over the entire body as widely scattered petechiae and as ecchymoses located interorbitally, over the temples, over both malar eminences and down the left cheek to a line with the mouth. The purpural markings were dark purple or black, indicating that the extravasating blood contained reduced hemoglobin and (probable) methemaglobin. Edema, most marked interorbitally, was present over the whole of the face, extending to the clavicle on the left side. A small (2 mm.) hemorrhagic bulla was present beneath the left eye. A small puncture wound penetrating the skin and subcutaneous tissues to the bone was present over the left side of the bridge of the nose at a point marking the junction of the frontal portion of the maxilla, the nasal, and the frontal. A series of five superficial punctures, approximately equidistant and arranged in a slightly bowed line were present over the mandible. The puncture line at right angles to the lip measured 9 mm. and was located inferior and just anterior to the right mental foramen. Another superficial, four millimeter, transverse laceration on the lower lip was located laterally to a projected line from the five punctures through the lip. I was informed by Dr. Johnson that these five punctures and the laceration were not bleeding at the time the child was admitted to the hospital and that they did not bleed at any time thereafter. Other short superficial lacerations were present over the facial swelling. I was informed that without exception these were surgically induced. The lungs were found to be congested but free from hemorrhage. Two hilar petechiae were found in the right lung and one in the left. The thymus was engorged and turgid but was consistent in size with the age of the

patient. Numerous petechiae were present in the visceral layer of the pericardium. The pericardial fluid was slightly blood-tinged but not increased in amount. The heart was engorged but not hemorrhagic and was in a state of diastolie. There were only rare petechiae over the intestinal serosa. The mucosa of the esophagus, stomach, duodenum, and jejunum was engorged and hemorrhagic with considerable extravasation of blood into the respective lumina. The ileum was less extensively involved, and no hemorrhage was discovered in the large bowel. The spleen, kidneys, and liver were moderately engorged but were free of

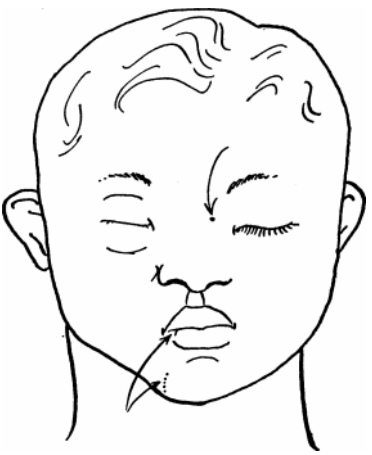

Fig. 1. Diagram showing position of wounds.

hemorrhage with the exception of a few pericapsular petechiae in the kidneys. The adrenals appeared normal. Due to an unfortunate lapsus on my part, the urinary bladder was not examined. A considerable bloody extravasation (25 cc.) existed in the subaponeurotic layer of the scalp, as far distally as the temporal bones. The brain was rigid due to embalming fluid but did not appear to be markedly engorged. No hemorrhage was present in the basal nuclei nor in any part of the brain. A slight bloody exudate was found penetrating the cribiform plate. The orbital portions of the anterior cranial fossa were chiseled out for a superior approach to the orbital contents. Extensive periocular hemorrhage existed in the right orbit. Considerable hemorrhage was also present in the vitreous body. It is presumed that hemorrhage occurred as well in the anterior chamber of the eye. In the left orbit hemorrhage was

present only in the insertional halves of the six extrinsic muscles. No intraocular hemorrhage was found.

While the histolytic and hemolytic effects of the rattlesnake's venom could have been sufficient to cause extensive conjunctival bleeding from the right eye, it seems only reasonable that as much or more bleeding would have occurred from the left eye, since the fang puncture was in the left half of the face and especially since most of the purpura and edema were on the left side. It is possible but not probable that intraocular hemorrhage could have accompanied the conjunctival and periocular hemorrhage from the fang puncture on the left, but it is practically impossible for such to have occurred without accompanying intraocular hemorrhage on the left. The only possible explanation is that the visible bleeding puncture on the left nose bridge was caused by the right fang of the snake, while the left fang penetrated the sclera of the right, opened eye, missing both eyelids. As was stated earlier, it was impossible to open the swollen eye to demonstrate this, and to have done so at the autopsy would have unduly mutilated the face for the mortician. The distance between the visible fang puncture and the medial corner of the right eye was 25 mm. The face was badly swollen, of course, and a distance of 16 mm. would be more accurate for the two-year-old face. This means that a rattlesnake with a fang spread of 18 mm. could have inflicted the wound as described above. Several *Crotalus atrox* and C. *s. scutulatus* from my private collection ranging in length from three to three and a half feet were measured. These were found to have fang separations of 17-21 mm., thus corroborating the opinion expressed at the autopsy that the damage was done by a three-foot snake.

Herbert **L.** Stahnke of Arizona State College at Tempe was also present at the autopsy. For some reason not disclosed to me, he came to the conclusion that the bite was inflicted by a Gila monster. This opinion is entirely inconsistent with all available evidence, and, inasmuch as it would distort all the currently recognized facts about the poison and habits of the Gila monster to have the erroneous opinion (which was widely circulated over television) that a Gila monster could possibly have inflicted the type of death described above, **I** shall elaborate on the overwhelming evidence that the damage was done by a rattlesnake.

First, it is well known that the Gila monster does not have a closed system of injecting venom as does the rattlesnake and that the poison is elaborated by salivary glands in the lower jaw. For a considerable quantity of the venom to reach the circulation of a victim, the Gila monster must therefore hold on and chew, while the saliva haphazardly contacts the wound. It is currently recognized that the lizard has strong jaws, and if it does get a good hold on a victim the surface tissues of the

victim are considerably mutilated. Yet the attending physicians state that the only visible perforations on the child were the one bleeding puncture mark on the nose, the five small linear perforations on the chin, and the small lip laceration. Perhaps Professor Stahnke did not hear the physicians state that the other incisions were surgically produced. The puncture marks on the chin are identical with those of the left lower jaw of a snake. Certain species of rattlesnakes are easily panicked and strike hysterically, sometimes failing to bite, often biting with little or no release of venom or biting with the fangs improperly elevated, thus failing to puncture the skin with the fangs. The small gash on the lower lip may be presumed to have been produced by the left fang. The snake struck a second time with the left lower jaw lacerating the chin while the fangs missed contact in the open mouth. As the fangs contracted in the bite accompanying the strike (Pope and Perkins, 1944) , the left fang gashed the lower lip. As the face is rounded and the strike was probably angling, the right lower jaw and fang missed altogether. It is impossible to conceive of a Gila monster leaving five minute punctures from only one of his four jaw halves. Further, it would have been utterly impossible for the subequal evenly graduated teeth in a Gila monster's mouth to have produced a single, bone-deep penetration on a recessed portion of the child's nose. If the right orbit were penetrated by a Gila monster's teeth, the eyelids would have been severely lacerated. It is easy to see how the two long, highly specialized, maxillary fangs of a rattlesnake could penetrate the open right eye and the skin of the nose. Absence of right ancillary pterygoid fang marks is explainable by right maxillary fang penetration being halted by the child's skull short of contact by the ancillary teeth. The left ancillary teeth would have then been in the space between the bridge of the nose and the right cheek. The lower jaw of the snake could have failed contact with the face by the angle of the child's head or through being held away from the face by contact of the upper jaw with the projecting nose.

Secondly, the pathological findings are inconsistent with those which would have resulted from *Heloderma* poisoning but consistent with those of *Crotalus* poisoning. Heloderma venom exerts a largely neurotoxic action (Loeb, 1913 ; Van Denburgh, 1897) with only moderate swelling. While proteolytic enzymes are present with their consequent hemorrhagic effects (Shannon, 1953a) , these effects are trifling compared to those of rattlesnake venom. Laboratory animals bitten by Gila monsters in my possession have invariably died of generalized voluntary muscular paralysis (cholinesterases?) accompanied by a primary respiratory paralysis. On the other hand, the stricken child retained his muscle tone, and the respiratory cessation was due to anoxia, as stated above. In

addition, the pathological findings could only have been caused by powerful proteolytic enzymes ; by hemorrhagic enzymes such as the phosphatidases with their accompanying histaminic action and by the hyaluronidases as described by Porges (1953) . The hyaluronidase activity of *Heloderma* venom is low and that action, combined with a low proteolytic activity, does not produce the typical, cleanly delineated, rapidly progressing swelling with accompanying purpura such as is produced by movement of rattlesnake venom in the subcutaneous tissue spaces of the victim (Shannon, 1953b) .

Third, the cotton fields of Goodyear are outside the known or expected geographic range of the Gila monster. This may seem surprising at first since Goodyear is only 20 miles west of Phoenix, where the lizards are abundant. In preparation of our forthcoming book on the reptiles and amphibians of Arizona, Charles **H.** Lowe, Jr. and **I** have compiled data on every Gila monster recorded from Arizona in the literature and have examined the individual specimens in most of the museums in the United States. It is evident that the Gila monster in southwestern Arizona does not pass from the rocky areas above 1000 feet in the succulent Arizona Upland Desert, where it is common, into the sandy, more arid land of the ecotone around Goodyear (Shreve, 1951) . This ecotone grades into that portion of the microphyllous Lower Colorado Desert of Yuma County. Relict populations may eventually be found in the White Tank Mountains to the north or the Sierra Estrellas to the south as well as other mountain ranges similar to the Baboquiviris where they are known to exist. Two isolated Gila monster records from near Ehrenberg and Parker may be considered as doubtful, or as escapes, as they occur on the road. Or the lizard may actually penetrate from the adjacent Mohave Desert. In spite of repeated futile collecting around the Goodyear area during the past six years, **I** do not state that an occasional Gila monster does not penetrate these cottonfields or that the child did not have a pet *Heloderma* of his own. However, it is extremely doubtful. On the other hand, numerous diamond-back and Mohave rattlesnakes have been collected in this same area by myself and others.

I should like to express my appreciation to my wife, Ellen, for the illustration and for certain technical criticism. I am indebted to Drs. Sam Johnson and Richard McMillan for contribution of data and criticism of the manuscript, and to Dr. Thomas Bate for inviting me to be present at the autopsy as well as furnishing me data. I am grateful to the pathologist, Dr. Campbell, for furnishing me useful data as well as expending considerable extra effort to show me many tissues. A special note of thanks should be extended to Professors Charles H. Lowe, Jr.

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